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THE BIOLOGY OF CANADIAN BARKBEETLES

THE SEASONAL HISTORY OF DRYOCOETES CONFUSUS SW.*

BY W. G. MATHERS,
Vernon, B. C.

The seasonal history of *Dryocoetes confusus* Sw., in trunks of *Abies lasiocarpa* (Hook) Nutt., as found under cage conditions at Stanley, B.C., during the two years 1929 and 1930 is summarized in the following statement.

In 1929 the first emergence of hibernating young adults occurred in the latter part of June. This flight continued throughout the greater part of July. Shortly after emerging the new adults attacked fresh trees in which they excavated first brood tunnels. Egg laying in these tunnels was not completed for the season until well into August. Following this the parent beetles commenced the excavation of feeding tunnels, the male by cutting a fresh tunnel from the nuptial chamber and the female by continuing their individual egg tunnels, such portions being recognized by the absence of egg niches. The winter was passed by the parent adults in these tunnels. On the resumption of activity in the spring the females again set in to prolong the same tunnels, first again as feeding tunnels and then as egg tunnels with eggs again being deposited in the freshly excavated extensions. By June 30 the newly cut portions of the tunnels were up to 25 millimetres in length and with from 5 to 14 eggs present in each. This egg laying continued in the first brood tree into the first week of July, after which the parent beetles re-emerged and entered a fresh tree in which a third set of brood tunnels was cut. Larvae from eggs laid in these tunnels were first noticed on August 16 and by August 26 approximately 25% of the eggs had hatched, but in no tunnel less than 23 days of age were young larvae found. Egg laying was completed in these new tunnels by the middle of August and, although the parent adults were still present in the tunnels at the end of the season, it was believed that they would not retain their vitality throughout this, the second winter.

The progeny of the first brood tunnels, excavated in July and early August 1929, were still in the egg stage on August 16 when the last observation of that season was made. However, the first observation of the 1930 season showed that approximately 10% of these eggs had hatched and by June 21 the young larvae had cut mines up to 25 millimetres in length. These eggs had undoubtedly hatched in the latter part of August and had passed the winter as young larvae. The heavy egg mortality was no doubt due to the unusual wet cold weather experienced in this district throughout the summer of 1929. The first pupa of this brood was observed on July 30 and by August 19 new adults were to be found. On August 26 these new adults were still present in the tree in which they no doubt were prepared to remain until the following spring, thus giving a life cycle of practically two years for *Dryocoetes confusus*

*Contribution from the Division of Forest Insects, Entomological Branch, Dept. of Agric., Ottawa.

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Sw., under such conditions as existed during 1929 and 1930 in this locality.

Parent Beetle	Egg Tunnels	Date of Attack	History of Progeny
Hibernated young beetles	1st tunnels	July 1929	Progeny hibernated winter of 1929-30 as young larvae and winter of 1930-31 as young adults to emerge June-July 1931.
Parent beetles hibernated winter of 1929-30 in first set of tunnels.			
	* 2nd tunnels	* June 1930	Progeny hibernated winter of 1930-31 as young larvae.
	** 3rd tunnels	July 1930	Progeny hibernated winter of 1930-31 as young larvae.

* extensions to first set of tunnels.
** 3rd set of tunnels cut in a fresh tree.

NOTE ON THE BITING MIDGE, CULICOIDES OBSOLETUS MGN., IN EASTERN CANADA

BY C. R. TWINN
Ottawa, Ont.

Little appears to have been written about the tiny biting midges known popularly as "punkies", "no-see-ums" or "sand-flies" which are prevalent in June and July and persist into August, in many wooded sections of Eastern Canada. Dunn (Dom. Dept. Agr. Pamph. 55, N.S., 1925) says of them that "owing to their minute size, their habit of entering the clothes and biting all parts of the body, and the extreme irritation of the skin resulting from their bite, they are, when numerous, one of the most serious pests of the woods. They attack at all times of the day and night, but are usually worst between daylight and sunrise."

During the past summer, reports were received of the presence of punkies in annoying abundance on the north shore of the St. Lawrence, in Quebec, and on the south shore in Rimouski county (E.B. Watson), and in the Laniel district, Que. (M.B. Dunn), and the writer had personal experience of their blood-sucking habits in the forested country at Algonquin Park, Ont., and in the wooded hills of the Gatineau, in Quebec, a few miles north of Ottawa.

Specimens of these insects were collected in the Gatineau hills, in the vicinity of Pink's lake and Chelsea, Que., on various dates from June 5 to June 29, 1931, and were forwarded to W. A. Hoffman, of the School of Tropical Medicine, San Juan, Porto Rico, for determination. Mr. Hoffman kindly identified them as *Culicoides obsoletus* Mgn., and stated (in litt. 14.ix.31) that this species "has previously been called *sanguisugus,* but comparison of male hypopygia with those of the European *C. obsoletus* show them to be identical."

As in the case of mosquitoes and blackflies only the female punkies bite. Their bite inflicts a sharp needle-point of pain and leaves a lingering irritation, but does not cause blood to flow. The female flies were observed to be most active towards sundown and at and after dusk (6-9 p.m. E. S. T. late in June), but small numbers also were seen to attack cattle and man during the daytime, usually in shady situations, or in the open when the sky was overcast.

SOME NEW NORTH AMERICAN DIPTERA

BY C. H. CURRAN,
American Museum of Natural History, New York, N. Y.

In a recent contribution in this Journal, I described a few new Diptera from Canada. The present paper contains descriptions of six new Canadian species and two from the United States, the types of the Canadian species being in the Canadian National Collection. The descriptions of two of the species of *Ptiolina* in this paper have been prepared by Dr. M. D. Leonard and are included in order that the key to species may be complete. From our study of this genus it seems probable that there are other species to be found, especially in the north where so little collecting has been done.

Rhagionidae

KEY TO THE SPECIES OF PTIOLINA ZETTERSTEDT

1. Mesonotum with gray and black vittæ ..... 3.
   Mesonotum not vittate ..... 2.
2. Mesonotum uniformly brownish gray or grayish brown; scutellum grayish 6.
   Mesonotum dull blackish; scutellum rather shining .....5.
3. Abdomen black, the segmental apices broadly gray .....*fasciata* Loew.
   Abdomen unicolorous or nearly so, never conspicuously fasciate ..... 4.
4. Gray vittæ of the mesonotum narrow, the outer dark vittæ entire *obsoleta* n. sp.
   Gray vittæ wide, the median blackish vitta divided by a slender line .....*majuscula* Loew.
5. Posterior tibiæ with long, mostly erect pile .....*alberta* n. sp.
   Legs with shorter, appressed pile .....*edeta* Walker.
6. Posterior tibiæ with longer, erect pile on the basal half ..... 7.
   Posterior tibiæ with only short, appressed pile .....*mitis* n. sp.
7. Third antennal segment subcordate; length 3 mm. .....*augusta* n. sp.
   Third antennal segment subrectangular; length, 5 mm. .....*grisea* n. sp.

Ptiolina augusta n. sp.

Related to *mitis,* n. sp. but the posterior tibiæ bear long, erect hair on the basal half, the pollen is more brownish, the stigma sharply defined, etc. Length 3 mm.

Male. Head black, brownish pollinose, black pilose; vertical triangle only thinly pollinose and pilose. Palpi black. Antennæ black; third segment subcordate, constricted on the apical fifth; style longer than the third segment, wholly without hair and tapering to the apex.

Thorax with grayish brown pollen and black pile.

Legs black; tibiæ brownish, the posterior pair with long, erect black hair on the basal half, and shorter sub-appressed hair on the apical half.

Wings tinged with brown, the large stigma dark brown and sharply defined. Second posterior cell short petiolate. Squamæ and halteres brown.

Abdomen black, grayish brown pollinose, black haired. The dorsum is only thinly pollinose and bears erect pile; pile of the venter appressed.

Holotype, male, Natashquan, Quebec, August 8, 1929 (W. J. Brown) in Canadian National Collection.

Ptiolina mitis n. sp.

Most closely related to *edeta* Walker but at once distinguished by its brownish gray color. It agrees with *edeta* in having only short hair on the legs.

Length, 3 mm.

Male. Head black, gray pollinose, black pilose; vertical triangle thinly pollinose and pilose. Palpi black. Antennæ black, the third segment rather small, sub-cordate, with several hairs on the basal half; style shorter than the third segment, thick, distinctly two segmented, the basal segment with a single hair at the apex above, the second ending in several hairs.

Thorax gray pollinose, the disc of the mesonotum more brownish; hair black; pleura bare, the propleura pilose.

Legs black or brownish, thinly pollinose; hair short, appressed on the tibiæ.

Wings pale brownish gray, the stigma pale brown, not sharply defined; second posterior cell angulate at the base, not petiolate. Squamæ brownish and with blackish fringe. Halteres reddish brown.

Abdomen black, cinereous pollinose, black haired. The pollen is inclined to be more brownish in the middle of the dorsum.

Holotype, male, Natashquan, Quebec, June 21, 1929 (W. J. Brown), in Canadian National Collection.

The two following species are described by Dr. M. D. Leonard.

Ptiolina alberta n. sp. (Leonard)

Apparently nearest to *edeta* Walker from which it may be separated by the longer erect pile on the legs, especially on the posterior tibiæ. Length 5 mm.

Male. Head blackish, grayish pollinose; pile brownish, the vertical triangle with long pile. Palpi blackish, and black pilose. Antennæ black, third segment sub-cordate; style somewhat longer than the third segment and tapering at the apex.

Thorax with mesonotum and scutellum uniformly blackish with at most slight traces of vittæ which are due to thinner opaque blackish pollen; pile moderately long, black, fairly abundant.

Scutellum like mesonotum.

Legs brownish, femora a little darker than the tibiæ and tarsi; hind tibial hairs long dorsally, growing shorter toward the tip.

Wings, including squamæ, tinged with grayish; stigma not sharply defined; halteres brown.

Abdomen opaque black, very slightly shining in some lights; hairs moderately abundant and brownish or blackish.

Holotype, male, Banff, Alberta, July 22, 1915 (Sanson), in Canadian National Collection.

Ptiolina obsoleta n. sp. (Leonard)

Nearest to *majuscula* Loew but the grayish vittæ of the mesonotum distinctly narrower and the median broad blackish area not divided by a lighter hue. Length 5 mm.

Male. Head (mostly eaten away) but parts still remaining blackish. Palpi black and with moderately long, blackish hairs.

Thorax blackish in ground color, sub-opaque, the broad anterior border and two narrow distinct vittæ which do not reach the scutellum, light gray; pile moderately long, black, fairly abundant. Scutellum black, unicolorous.

Legs brownish black, the femora lightly pollinose, the tibiæ and tarsi

brown; tibial hair long dorsally, shorter toward the tip.

Wings tinged with pale brownish; stigma not sharply defined; second posterior cell not petiolate; squamæ tinged with pale brownish; halteres brown.

Abdomen opaque blackish, very slightly shining; hairs blackish or brownish.

Holotype, male, Michigan Agricultural College, June 5 (or May 6) 1895, in American Museum of Natural History.

Ptiolina grisea n. sp.

Black, clothed with brownish gray and grayish pollen; stigma large; posterior tibiæ long haired. Length, 4.75 to 5.5 mm.

Male. Face, cheeks and posterior orbits grayish pollinose; facial orbits, vertical triangle and occiput rather brownish pollinose; hair black, brownish on the cheeks. Palpi black. Antennæ black, the third segment large, subrectangular, gently narrowing to the transverse apex; style about as long as the third segment, thick, its apex pointed, the basal segment constricted.

Thorax evenly cinereous pollinose; hair black; pleura bare, except on the middle of the propleura.

Legs blackish, black haired, more or less cinereous pollinose; hair long except on the tarsi.

Wings cinereous hyaline, the veins pale brown; stigma brown. Squamæ pale, brown bordered, the fringe pale on the outer third. Halteres brown.

Abdomen brown, thinly grayish brown pollinose, the venter more thickly pollinose. Hair wholly black.

Female. Front wide, brown pollinose, rather shining in the middle, the anterior fifth and face grayish pollinose; frontal hair abundant, black; hair on cheeks and proboscis yellowish. Hair on posterior tibiæ becoming short apically.

Holotype, male, *allotype,* female and one male paratype, Mt. Washington, N. H., (Slosson Collection), in American Museum of Natural History.

The holotype has the wings damaged, one wing being mostly missing and the stigma broken from the other; the paratype has the thorax partly stained. These specimens were labelled *Spania edeta* Walker in the Slosson collection, but the presence of long hair on the posterior tibiæ and grayish thorax are distinctive characters.

Syrphidae

Platycheirus femineum n. sp.

Undoubtedly related to *varipes* Curran and *albimanus* Zetterstedt, but readily distinguished from either by the non-produced face and the very small tubercle. Superficially it resembles *Melanostoma nitidiventris,* n. sp., but the anterior femora bear a long, curved, white hair which, while not as strong as in the males of *Platycheirus* is indicative of the generic position of the species. Length, 8 mm.

Female.—Head black, cinereous pollinose, the tubercle, oral margin, a triangle on the cheeks, and the front, shining; front with the sides broadly cinereous pollinose, the pollen triangularly produced inward at the middle of the front; frontal depression limited above by a broad V-shaped line, the angle of the V in front; pile of the head pale yellowish, that on the front black. Front wide above, gently widening anteriorly. Face perpendicular, the tubercle large,

but not prominent, roundish. Antennæ wholly black; third segment convex below, one-fourth longer than wide.

Thorax shining greenish black, the pleura and lateral margins of the mesonotum gray pollinose; pile wholly pale yellowish.

Legs reddish yellow; coxae blackish, gray pollinose; anterior four femora blackish above, the posterior pair black except the apex; posterior tibiæ black with the broad base and apex reddish; posterior tarsi black the intermediate segments more or less brown; apical three segments of the anterior four tarsi black or brown. The hair is yellowish, the long hair on the femora mostly black; anterior femora with a peculiar, compound, curved white hair at the base postero-ventrally.

Wings cinereous hyaline, the stigma luteous. Squamæ whitish, with yellow border and fringe. Halteres reddish yellow.

Abdomen sub-shining black, with four pairs of hoary spots, the anterior pair indistinct. Spots on the second segment longer than wide, grayish, widely separated from each other and from the posterior margin of the segment. Spots on the third and fourth segments transverse, broadly separated in the middle, occupying slightly more than the basal half of the segment; spots on the fifth segment sub-triangular, narrowly separated from each other, gently convex behind and reaching almost to the apical third of the segment toward either side. Pile short, pale yellowish, black only on the sub-opaque parts on the middle of the abdomen and on the apical segments. Venter brownish, thinly pale pollinose, the pile wholly pale.

Holotype, ♀, Tabatiere, Quebec, July 11, 1929 (W. J. Brown) in Canadian National Collection.

Paratype, ♀, Harrington Harbor, Quebec, July 2, 1929, in American Museum of Natural History.

It is not impossible that this may prove to be the female of *hyperboreus* Staeger (not Williston). I have seen no females of *hyperboreus*, unless a specimen was contained in a collection received by the Entomological Branch from Labrador and which included a male.

Melanostoma nitidiventris n. sp.

Related to *obscurum* Say but the abdomen is wholly shining, with obscure sub-opaque markings. Length, 8.5 mm.

Female. Head black in ground color, gray pollinose, a broad median facial stripe not reaching the antennæ, a triangle on the cheeks anteriorly, upper half of front and a median vitta which expands above the antennæ bare and shining; pile whitish, the occipital cilia and frontal pile black. Face produced below, the oral margin slightly produced; tubercle long and nose-shaped; face gently concave above. Front rather narrow above, strongly widening anteriorly, in the middle with a broad V-shaped depression, its apex above. Facial pollen with small round spots forming indistinct ripples. Antennæ brown; third segment reddish below, about twice as long as wide.

Thorax blackish green, cinereous-white pilose, the scutellum with a few coarse black hairs on the apical border; pleura thinly cinereous pollinose.

Legs reddish; coxæ black; bases of the femora broadly brownish. sometimes the basal half brown, in which case the posterior pair are brown on the

basal two-thirds; posterior tibiæ broadly brownish red in the middle; posterior tarsi and the apical three segments of the anterior four, black or brown. Hair pale, black on the apical three or four segments of the posterior four tarsi.

Wings hyaline, the subcostal cell yellowish. Squamæ whitish, with yellow border and fringe. Halteres yellow.

Abdomen shining greenish black, slightly æneous, in some lights with obscure, dull markings. Second segment with the broad posterior border, narrowing laterally and broadly produced in the middle to join a transverse, basal triangle, sub-opaque, the middle of the segment shining, so that the dull markings are medianly interrupted. Third segment with the posterior half in the middle, tapering laterally and broadly interrupted by a median vitta, sub-opaque. Fourth segment with at most traces of darker coloration on the apical fourth. Sides of the abdomen wholly shining. Pile pale yellowish on the base of the abdomen and on the lateral margins, elsewhere black and short. Venter shining greenish black, with very short, pale hair.

Holotype, ♀, Jordan, Ont., May 13, 1915; paratypes, ♀, Jordan, May 9, 1915 and ♀, Orillia, Ont., May 5, 1921 (Curran). Type in Canadian National Collection, paratype in American Museum of Natural History.

While this species is closely related to *obscurum* Say and *confusa* Curran it may be readily separated by its almost parallel-sided abdomen, at most sub-opaque abdominal markings and the shape of the frontal depression. I have delayed publishing the description in the hope that the male might be discovered, but since the possiblity of collecting in the localities where I found the specimens is remote, I now present a diagnosis of the species.

Melanostoma agens n. sp.

Resembles *rufipes* Williston in general appearance but the face is protruding below. Length, 9 to 10 mm.

Male. Head black, clothed with cinereous pollen; lunula, median facial stripe, the anterior part of the cheeks and the vertical triangle shining; posterior orbits rather silvery. Pile whitish; black on the frontal and vertical triangles; occipital cilia cinereous. Head longest below, strongly produced, the moderately large tubercle as prominent as the tip of the oral margin. Antennæ black, the third segment reddish on the lower half except at the apex; arista luteous; third segment oval, a little more than one and a half times as long as wide.

Thorax metallic greenish black, the mesonotum with a slight brassy tinge; pile short and rather tawny, yellowish on the pleura. Scutellum large, obtuse apically. Upper and anterior border of the pleura cinereous pollinose.

Coxæ black, the anterior pair cinereous pollinose. Anterior four femora black on the basal half, reddish apically, the posterior pair black on the basal two-thirds. Tibiæ reddish, with a broad black band situated mostly beyond the middle. Tarsi brownish, the basal two segments of the anterior four reddish, the apical segments of the front pair sometimes only a little darkened. Hair yellow, black on the apical three segments of the posterior four tarsi.

Wings tinged with brownish; apical crossvein gently curved, the apical cell not pointed at the apex. Squamæ yellowish white, with yellow fringe and brownish yellow border.

Abdomen shining metallic black, the sides bronzed, the spots on the second and third segments more or less strongly bronzed. Second and third segments each with a very large, opaque black posterior triangle which reaches to the base of the segment in the middle, the fourth segment with indications of a similar triangle. The lateral margins are wholly broadly shining, while the metallic spots on the second to fourth segments are rather thinly overlaid with cinereous white pollen. Pile short and black, longer on the sides of the abdomen, reddish yellow on the first segment, on the metallic spots of the second and third segments and on the sides of the second and third. Abdomen long, gently widening to the apex of the fourth segment. Venter and genitalia shining black.

Female. Front rather narrow above, gradually widening from the upper fourth to the lower edge; sides cinereous pollinose on the lower third, the pollen only a little expanded above; frontal pile black, at the vertex tawny, usually with a trace of yellow across the lower third. Pile of the mesonotum and scutellum brassy yellow, of the pleura, white. Tibial bands brownish and less extensive, sometimes only weakly developed. Abdomen more oval, with only subopaque markings, the triangles much more transverse and only weakly produced forward. In some views the abdomen appears to have broad shining black bands on the apices of the second and third segments. The pollinose spots are much less conspicuous and the abdomen, while more extensively shining than in the male, lacks the bright bronze reflections of that sex. The pile is shorter and the pale pile more yellowish. The wings are usually cinereous, rarely brownish tinged as in the male.

Holotype, male, Melita, Man., July 9, 1927 (E. and S. Criddle).

Allotype, female, Waseca, Sask., July 10, 1926 (N. J. Atkinson).

Paratypes, three males, Beulah, Man., July 13, 1927, (E. and S. Criddle); one male, same data as holotype; one male, Pierson, Man., July 3, 1927 (H. J. Brodie); one female, Penzance, Sask., July 8, 1925 (K. M. King); three females, Harrington Harbor, Que., July 2, 3, 1929 and one female, Old Fort Island, Que., July 13, 1929 (W. J. Brown). Types in Canadian National Collection, paratypes in the American Museum of Natural History.

NEW NORTH AMERICAN CAENINAE WITH NOTES (EPHEMEROPTERA)*

BY J. MCDUNNOUGH,

Ottawa, Ont.

Genus **Caenis** Steph.

Apart from the small size of the insects the main obstacle in determining material in this genus has been the difficulty in identifying the species described by older authors. For some time we have been amassing material in the group and I believe that, with more or less topotypical specimens of every described species before me, I have tied down these names with a reasonable amount of surety.

Characters drawn from the male genitalia, notably the length of the forceps and the shape of the basal plate, seem to offer good means of separation

*Contribution from the Division of Systematic Entomology, Entomological Branch. Dept. of Agric., Ottawa.

for the various species; the penes, which are united to form a thin eversible membranous sack with the apical portion more or less bent upward, are best observed in either alcohol material or in weak alcohol after treatment with caustic potash; the membrane, due to its delicacy, nearly always collapses during the process of making a slide. In my drawings I have endeavored to reproduce as closely as possible what seems to be the normal shape of this organ but it is probable that this varies to some extent according to the amount of distention and is therefore not a reliable means of separation.

The individual species appear to have a wide range and undergo considerable variation in color and maculation. I have refrained from describing species as new unless they showed tangible genitalic differences but it is quite possible that, when more is known of the early stages, some of these variations may prove to be specific in character; for this reason I have, as far as possible limited my type series to specimens from a single locality.

KEY TO SPECIES

1. Abdomen without dark stigmatal dots or streaks 2
   Abdomen with dark stigmatal streaks on at least some of the segments.. 3
2. Head and thorax pale; abdomen almost immaculate .....*ridens* n. sp.
   Head and thorax dark; abdomen with two lateral bands of blackish shading .....*tardata* n. sp.
3. Stigmatal streaks confined to posterior abdominal segments; head pale .....*hilaris* Say
   Stigmatal streaks present on anterior abdominal segments; head, at least partially, dark-shaded 4
4. Hind femora with a dark apical band 5
   Hind femora with the band reduced to a dark dorsal streak 6
5. Femora sprinkled with black dots .....*punctata* n. sp.
   Femora unsprinkled .....*diminuta* Wlk.
6. Head crossed by a band of purplish or ruddy shading, leaving the posterior portion paler 7
   Head entirely suffused with purplish or blackish 9
7. Mesonotum light yellow-brown; size small (3 mm.) male forceps of moderate length .....*jocosa* n. sp.
   Mesonotum deeper brown; size larger 8
8. Mesonotum light brown; male forceps very long, thin and straight .....*forcipata* n. sp.
   Mesonotum deep brown; male forceps not so long and slightly curved .....*latipennis* Banks
9. Size small (3 mm.); male forceps short .....*amica* Hagen
   Size large (4-5 mm.); male forceps moderate, curved .....*simulans* n. sp.

Caenis hilaris Say

Fig. 1.

Ephemera hilaris Say, 1839, Jour. Acad. Nat. Sci. Phil. VIII, 43; LeConte, Edit. II, 413.

Hilaris was described briefly from specimens taken at light on Sept. 4 in Indiana, presumably at Say's home. The original description reads as follows and I have italicized certain important characters: "Body *white*, eyes black, double; stethidium *pale fulvous;* pleura and pectus with a few abbreviated dusky lines; wings two, ample, costal margin slightly dusky; abdomen depressed, *with*

three brownish punctures on each side towards the tip; seta elongated. Length one-tenth of an inch."

I have before me the following pinned specimens—4 ♂, Oregon, Ill. July 18; 6 ♀, Ames, Ia. July 22; 1 ♂, 1 ♀ subimago, Plummers Is., Md. July 24; 2 ♀, Washington, D. C. Aug.; and a fresh series of 15 females from Lawrence, Kansas, July, and Aug. 14; also alcohol material from Lawrence, Kan. and 1 ♀, Homer Park, Ill. Aug. 10. These specimens agree with Say's description in the salient points and I believe I am justified in applying the name *hilaris* to them. I present a more amplified description, drawn up from the Kansas females:—

Female.—Head whitish, with black eyes and pale ocelli heavily ringed with black at base; antennae slightly tinged with smoky beyond the basal joint. Pronotum whitish with two fine black dots posteriorly, situated one on each side of the median line; at times the antero-lateral edges are tinged with blackish. Mesonotum pale yellowish with faint blackish shading in the form of a V-mark before the posterior projection. Pleura and sternum pale with several short blackish streaks at the bases of the wings and legs. Abdomen whitish, frequently tinged with yellowish from the underlying egg-masses; segments I and II dorsally faintly shaded with blackish; on each lateral edge of segments VII-IX a fine, short, blackish streak (I interpret these as the three brownish punctures of Say); venter immaculate. Setae white. Legs white; all femora with a fine, short, black streak on the dorsal edge near apex; fore femora at times slightly tinged with smoky apically; fore coxae situated very close together, mid- and hind-coxae with a small blackish lateral spot. Wings semihyaline whitish with the subcosta and radius purplish-black for a greater part of their length. Length of body 2.5-3 mm.; of wing 2.5 mm.

Male.—Apart from secondary sexual characters essentially the same as the female. The head is light ruddy purple in most of my material but I think this is merely discoloration; the fore-femora are possibly slightly more shaded apically with smoky, the fore-tibia faintly smoky and about twice as long as the femur and the tarsus somewhat shorter than the tibia. Forceps short, whitish, evenly narrowing to an apical point, the basal plate projected backward more than usual and covering to a large extent the penes. Size slightly less than that of the female.

Caenis ridens n. sp.

Differs from *hilaris,* amongst other characters, in the entire lack of the lateral black abdominal dashes and the dashes on the dorsal edge of the femora.

Female.—Head whitish with slight smoky shading across the posterior portion between the rear ocelli; these and the eyes as in *hilaris;* antennae pale. Pronotum whitish, considerably shaded with smoky. Mesonotum pale yellowish with a slight brownish tinge, the color being somewhat deeper than that of *hilaris;* a faint median dark longitudinal line and considerably smoky shading on the posterior portion; wing bases inwardly with a slight dark streak. Metanotum with two faint dark transverse streaks near posterior margin. Pleura entirely pale except for a small curved dark mark before the base of the mid-coxa and a slight deepening of color anteriorly; sternum pale. Abdomen dorsally white with the smoky shading of segments I and II confined to the lateral

portions; no traces of the lateral streaks of *hilaris* on segments VII-IX; ventrally immaculate. Setae white, the middle one somewhat longer than the outer ones. Base of forelegs and entire fore femur considerably tinged with smoky, tibia and tarsi paler, the width between the leg-bases wider than in *hilaris;* mid- and hind-legs entirely whitish, immaculate. Wings as in *hilaris.* Size as in *hilaris.*

Holotype—♀, Lawrence, Kan., July, (Mrs. L. W. Brown); No. 3235 in the Canadian National Collection, Ottawa.

Paratypes—14 ♀, same data.

Caenis diminuta Wlk.

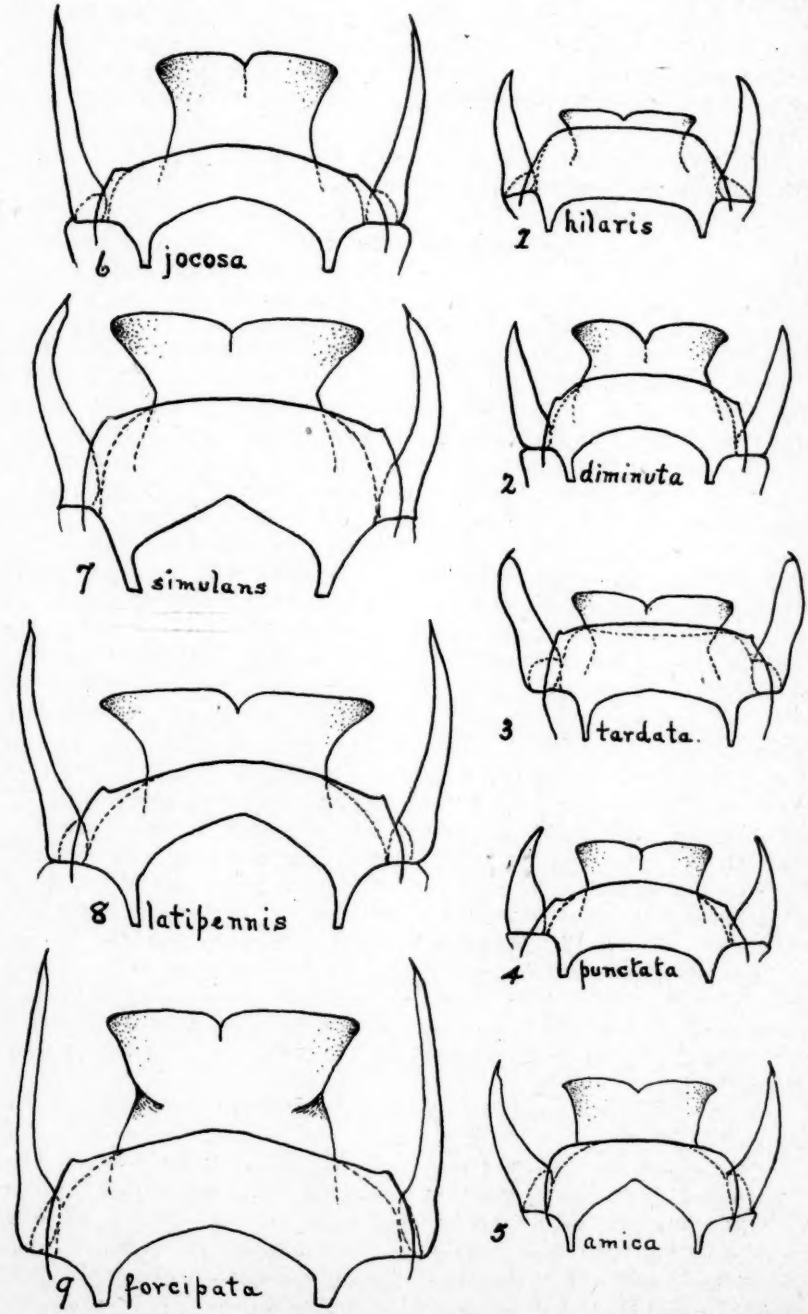
(Fig. 2.)

Caenis diminuta Walker, 1853, List Neurop. Ins. Brit. Mus. III, 584; Eaton, 1884, Rev. Mon. Rec. Ephem. 147.

Male.—Head blackish over a pale ground-color; antennae pale. Pronotum pale, heavily suffused with blackish, paling slightly laterally; frequently a fine black marginal line along the posterior and lateral borders. Mesonotum deep bronzy brown with slight smoky tinge, the posterior projection paler and shaded with black. Metanotum with a black transverse band. Pleura similar in color to mesonotum, shaded with black on the membranous portion anterior to the wing-base and with a few black streaks below the wing-bases. Sternum pale, slightly tinged with brownish. Abdomen pale yellowish white, shaded heavily dorsally with blackish on segments I-VI; on I and II and a part of III the mid-dorsal section is pale with a median black line; the lateral edge of all these segments is pale with distinct black stigmatal dots and the posterior edge is marked with a black line; on VII and VIII the black shading is reduced to two faint subdorsal patches, a dark stigmatal dash and a narrow posterior border-line; IX is more heavily black-shaded laterally with a deeper yellowish tinge dorsally in which is at times a faint black dot; X is yellowish. Ventrally pale yellowish with fine black streaks in the antero-lateral corners of segments I-VI and two more or less distinct black lateral dots on each side of segments VI-IX, placed obliquely, the posterior one nearest the median line; at times these dots, particularly the outer one, are visible on the anterior sections. Forceps and setae pale. Prolegs with coxae and femora smoky, the latter crossed by an apical blackish band; tibiae and tarsi paler with only tinges of smoky color. Mid- and hind-legs pale, whitish, the coxae faintly tinged with smoky and with a black lateral spot, the femora at times with traces of a fine black line on dorsal edge at base and with a distinct black streak on dorsal edge at apex, *continued downward along the outer side by brown shades so as to form an apical band.* Wings whitish hyaline, as usual with dark subcostal and radial veins. Length of body and wings; 3 mm.

Female.—Essential similar to the male in all details of maculation but larger in size, 4 mm.

This species was described from specimens from St. John's Bluff, Fla. and has been generally misidentified. I have before me a few males in alcohol from Stuart, Fla. collected in May and have matched these with a series of 8 ♂, 1 ♀ from Leg Lake, near Gravenhurst, Ont., Aug. 20, (R. Ozburn). The specimens agree well with Walker's and Eaton's descriptions; the extension of the apical femoral black dash into a band seems characteristic; this, along with



NORTH AMERICAN CAENINAE

the small size, the blackish head, the dark brown mesonotum and the short, stubby male forceps, much as in *hilaris,* should identify the species readily.

Caenis amica Hag.

(Fig. 5.)

Caenis amica Hagen, 1861, Syn. Neurop. N. Am., 55.

Following Eaton the species has been sunk as a synonym of *diminuta* but I am not at all certain that this is correct. The type, a male from Baltimore, Md. (Zimmermann), is in the Berlin Museum and through the kindness of Dr. G. Ulmer of Hamburg I have a very full description of this specimen. Two males before me from Indian Head, Md., June 20, seem to fit this description; they are undoubtedly very close to *diminuta* in general maculation but the mesonotum is slightly brighter brown and in the mid- and hind-femora the black apical streak is not continued downward to form a band and there is further a black streak on the outer side of the trochanter, which is lacking in all my specimens of *diminuta.* Combined with this is a slight difference in the male genitalia, the forceps, although short, being somewhat more curved and more finely pointed apically. I am, therefore, for the present holding the name *amica* to these two specimens until more material from this region is available for study.

Caenis punctata n. sp.

(Fig. 4.)

Separable from all species with short male forceps by the presence of scattered black dots over the mid- and hind-femora.

Male.—Eyes black, antennae pale; head shaded with purplish over a pale ground, giving a rather ruddy tinge to the whole vertex. Pronotum pale yellowish with a strong black border and heavy blackish shading over the median section, paling laterally; posterior portion paler with black streaking and dots and preceded by a black V-mark, outlining the sutures. Metanotum shaded with black. Pleura yellow-brown as in mesonotum, with blackish streak and shades anterior to wing base, some black suffusion over the episternum and rather heavy black streaking around the bases of the legs and below wing-bases. Sternum pale. Abdomen pale yellowish, suffused with blackish much as in *diminuta,* the pale areas being largely limited to the median sections of I and II and VII-X; black stigmatal dots or dashes on all segments; traces of a median black dotted line on I-III; a median black dot on IX and several minute black dashes on X. Ventrally pale, with the two pairs of obliquely-placed black dots very strong on segments VI-IX and the outer one visible on all the segments anterior to these; the usual black streaks along the lateral border. Setae and forceps pale. Forelegs shaded with blackish at base, coxa and trochanter largely pale with slight black streaking, femur deep smoky with a blackish apical band and traces of a median one, tibia and tarsus pale whitish with a slight smoky tinge. Mid- and hind-legs whitish with slight sprinkling of small black dots on the femora which show an apical black band as in *diminuta* and also traces of a median one, most marked on mid-femur; coxa and trochanter with black spot; hind tibia with an occasional black dot in basal portion. Wings semihyaline whitish with dark subcostal and radial veins.

Female.—Similar to the male in maculation but larger. Size, ♂, 3 mm.; ♀, 4 mm.

Holotype—♂, Hemmingford, Que., July 15 (G. H. Hammond); No. 3240 in the Canadian National Collection, Ottawa.

Allotype—♀, same data.

Paratypes—8 ♂, same data; 1 ♂, Ottawa, Ont., Aug. 26, (F. Ide).

The banding of the femora allies this species with *diminuta* which, however, is without the femoral black dots and has a deeper-colored thorax. The forceps are short, broad at the base, and narrowed considerably at about half their length so that the inner margin shows a strong curve in contradistinction to that of *diminuta*. It is probably this species which Needham figures (1905, Bull. N. Y. Sta. Mus. Pl. XI, fig. 6) as *hilaris* Say.

Caenis tardata n. sp.

(Fig. 3.)

Distinguished from other species with short male forceps by the deep brown mesonotum and the blunt apex of the forceps.

Male.—Eyes black, antennae pale whitish, head heavily shaded with blackish. Pronotum pale, shaded with blackish, deepest dorsally; traces of a fine black borderline dorsally but none on the lateral edges. Mesonotum deep brown with the sutures and lateral margins faintly marked in blackish; black shading on the posterior projection. Pleura deep brown with a pale area anterior to the wing-base margined dorsally by a black streak; dark streaks around bases of legs and along anterior margin of episternum. Sternum pale with slight brown tinge. Abdomen dorsally pale yellowish white, the first six segments with broad lateral blackish shading, separated by a pale median area, lateral margins pale, without stigmatal dots, a fine dark line along posterior margin; segments VII and VIII entirely pale, IX and X with faint dark shading and a minute median dot on IX. Ventrally entirely pale yellowish white with the last segment slightly deeper in color and a faint smoky transverse streak (not always present) across the median area near posterior border. Setae and forceps pale. Prolegs with deep brown shading at base, femora smoky with a darker apical spot, tibia and tarsi pale. Mid- and hind-femora pale whitish, coxa with a blackish spot on outer side and another spot on inside at base, femur with a fine dorso-apical black streak (this may be reduced until it is almost imperceptible). Wings as usual. Length of body and wing 3 mm.

Female.—Similar to ♂ in maculation but somewhat larger.

Holotype—♂, Lethbridge, Alta., Aug. 5 (J. H. Pepper); No. 3243 in the Canadian National Collection.

Allotype—♀, same data.

Paratypes—15 ♂, same data.

Besides the types I have long series of this species from Milk River., Alta., Sept. 13 (Pepper) and Indian Head, Sask., July 28, 29, Aug. 4, (J. J. deGryse).

Caenis jocosa n. sp.

(Fig. 6.)

Differs from *hilaris* in the rather deeper-colored thorax, the longer forelegs and the much longer and narrower male forceps.

Male.—Head pale yellowish, tinged with pale purplish between the eyes but with the rear margin paler again; antennae pale; eyes black. Pronotum

pale yellowish with two blackish dots posteriorly, one on each side of the median line, the area between and anterior to them faintly tinged with ruddy; lateral edge with slight black streaks. Mesonotum light yellow-brown, the posterior projection paler with faint smoky tinges; a faint smoky median V anterior to this section and a dark lateral streak anterior to the wing-bases. Metanotum with a transverse blackish median shade. Pleura pale yellowish, lightly shaded with yellow-brown, most intense on the episternal region; dark streaks at bases of wings and legs and along the anterior margin of mesopleura. Sternum pale yellowish. Abdomen pale yellowish with the dorsal area of segments I-VI suffused with blackish, leaving a pale lateral border cut by a dark line along the posterior margin of each segment; faint black stigmatal dots on segments I, II, V, VI; the blackish area on segment VII is reduced to two subdorsal patches but there is a larger and better defined stigmatal dot; segments VIII-X pale with very faint lateral black shading on VIII, faint median dark dot on IX, and two slight, blackish, median, longitudinal streaks on X; ventrally pale yellowish with a faint transverse lateral black streak on each of the segments I-V and two very faint, obliquely placed, dark dots on each side of segments VI-VIII, the anterior one near the lateral margin and the posterior one about one-half way between this margin and the median line. Forceps pale. Setae whitish. Forelegs tinged with blackish at base; femora smoky with a black dorso-apical streak; tibiae pale smoky rather more than twice as long as the femora; tarsi pale. Mid- and hind-femora pale yellowish with a black dot on coxa, a faint black streak on trochanter and a strong dorso-apical black streak on femur below which on the outer side is a small black dot. Wings semihyaline whitish with the subcosta and radius purplish-black as usual. Length of body and wings 3 mm.

Holotype—♂, Put-in-Bay, S. Bass. Isl. Ohio, July 1-10; No. 3236 in the Canadian National Collection, Ottawa.

Paratypes—8 ♂, same data, received through the kindness of Dr. C. H. Kennedy.

The type series shows considerable variation in the amount of black streaking and suffusion on the individual specimens. The holotype is one of the darkest specimens. In the palest one the dark shading of the head and prothorax has almost disappeared and only the two black dots are left of the prothoracic markings, the black dorsal suffusion on the abdomen is so faint as to be almost lacking and only the stigmatal dot of segment VII remains, even this being less prominent than in the holotype; ventrally there is no trace of the obliquely-placed dots. The mid- and hind-legs still show the black spot on the coxa and the apical dash on the femur but the basal dark shading is lacking. All manner of intergrades between these two extremes occur.

The species appears to be widespread and variable; apart from the variation as noted for the type series, I find in specimens from other localities that there is frequently a streak of black shading along the outer side of the two hinder femora and that the black abdominal shading can be even more intensified than in the holotype.

I have examined series from Homer Park, Ill., (Aug. 10); Orillia, Ont., (July 21); Arnprior, Ont., (Sept. 1); Black Rapids, Rideau Riv. Ont., (Aug.

21); Aylmer, Que., (July 20); Knowlton, Que., (June 20); Covey Hill, Que., (June 25); and Fredericton, N. B., (July 8).

Caenis forcipata n. sp.

(Fig. 9.)

Separable from *jocosa* by its larger size and darker mesonotum and from both *jocosa* and *latipennis* by the much longer and thinner male forceps.

Male.—Eyes black, antennae pale, head crossed by a blackish or purplish shade between the eyes but paler before the posterior margin. Pronotum pale yellowish, shaded with blackish in the median area; traces of a fine black border line, most distinct on lateral margins. Mesonotum dark yellow-brown with slight black shading on the paler posterior projection and a dark streak anterior to wing-base. Pleura similar in color to mesonotum except for paler areas anterior to and below the wing-bases; some dark streaks around the leg-bases. Sternum pale, with faint brownish tinge. Abdomen pale yellowish, suffused heavily with blackish dorsally on segments I-VI the pale color being restricted to small lateral areas around the stigmatal black dots and to a median area on segments I and II which show traces of a dotted black median line; segment VII with black subdorsal shades anteriorly, remaining segments pale; stigmatal dots present on segments I-VII, very heavy on VII, obsolescent on posterior segments; three black streaks dorsally on X. Ventrally pale yellowish with only faint traces of the pairs of obliquely-situated black dots on segment VI-VIII. Forceps and setae pale. Prolegs shaded with smoky at base and on coxae and femora, the latter showing a black dorso-apical spot; tibiae and tarsi pale with faint smoky tinge. Mid- and hind-legs pale yellowish, coxa with a black streak on outer side and a black dot on the postero-ventral edge, trochanter with a black streak on outer side and femur with a triangular dorso-apical streak, the apex pointing forward. Wings as usual. Length of body and wings 4 mm.

Female.—Similar to the male in maculation but larger and slightly paler, notably the head, prothorax and fore-femora; the head shows two median transverse black streaks at the posterior margin (probably present in the ♂, but hidden by shrivelling) and also the usual two black dots on the pronotum.

Holotype—♂, Algonquin Park, Ont., June 19, (J. McDunnough); No. 3242 in the Canadian National Collection, Ottawa.

Allotype—♀, Hemmingford, Que., July 15, (G. H. Hammond).

Paratypes—1 ♂, same data as holotype; 1 ♂, same data as allotype.

Four male specimens from Victoria Beach, Lake Winnipeg, Man., July 19 (Wallis) seem to belong here. They are slightly paler than the type series in the coloration of the thorax.

Caenis latipennis Banks

(Fig. 8.)

Caenis latipennis Banks, 1907, Ent. News, XVIII, 14.

I have two male specimens before me from the type locality, Pullman, Wash. collected on June 7 and July 11, 1898, which agree well with Banks' characterization. The forceps, as noted by him, are practically similar to those figured by Needham under the name *diminuta* (1905, Bull. 86, N. Y. Sta. Mus. Pl. XI, fig. 5).

Three males from Indian Head, Sask. I associate with these Pullman

specimens; they are very close in maculation to *forcipata,* showing the same coloration of head and pronotum as in this species; the mesonotum is darker brown and the black abdominal shading extends over on to the posterior segments to a greater extent; the forceps are also shorter as a comparison of my figures will show.

A small series of 3 ♂, 1 ♀ from Prescott, Ont. would, according to the male forceps, also fall here. These specimens are considerably paler than the western ones in thoracic coloration and in the amount of black abdominal suffusion but this seems to be the usual difference between eastern and western forms; it is probable that Needham's figure of so-called *diminuta* was based on similar specimens.

Caenis simulans n. sp.

(Fig. 7.)

Allied to *jocosa* but differing in the larger size, blacker head, lack of the two black spots on pronotum, broader and darker mesonotum and the thicker and more curved male forceps.

Male.—Eyes black, antennae pale, head above entirely suffused with blackish. Pronotum pale yellowish with a fine black border line and the median section strongly suffused with blackish which extends laterally along the anterior margin; two black dots of *jocosa* not evident. Mesonotum bronzy-brown, ratner deeper in color than *jocosa,* posterior projection paler, with faint black shading; a black streak and black shading anterior to the wing-base. Metanotum pale with black shading. Pleura of same shade of brown as mesonotum, paler around bases of legs with a few faint black streaks; anterior margin with a fine black line. Sternum light yellowish. Abdomen dorsally pale yellowish with black shading as in *jocosa* and black stigmatal dots well-developed on the first seven segments; a median broken black line on the first two or three segments; segments IX and X slightly deeper yellowish with traces of the dorsal dots found in *jocosa;* ventrally pale with the pairs of oblique black dots as in *jocosa,* faint black lateral dashes on the anterior segments and a rather faint row of small, round, brownish spots midventrally, one spot to a segment. Forceps with a faint smoky tinge. Setae pale. Forelegs shaded with blackish at base and on coxae; femora blackish with only a trace of the apical dark band or spot; tibiae and tarsi faintly smoky. Mid- and hind-legs pale yellowish, coxa and trochanter with slight black streaks and dots, dorso-apical femoral black streak present but fainter than in *jocosa.* Wings whitish hyaline with purplish subcostal and radial veins. Length of body and forewing 3.5-4 mm.

Female.—Very similar in maculation to male but larger, the average length of body and wing being nearly 5 mm.

Holotype—♂, Orillia, Ont., July 21, (C. H. Curran); No. 3239 in the Canadian National Collection, Ottawa.

Allotype—♀, same data.

Paratypes—9 ♂, 12 ♀, same data.

There is some variation in the amount of black abdominal shading in the type series and occasional specimens occur which show dark shades and faint lateral black dashes on segments VIII-X but in general these segments are less marked than in *jocosa;* the middorsal dotted line may extend as far as

IV and on the ventral surface the midventral spots may be lacking.

The species appears to be wide-spread and rather variable. I have examined specimens from the following eastern localities:— Scotch Lake, N. B. June 19; Knowlton, Que. July 20; Hemmingford, Que. July 15; Rideau Riv. Ottawa, Aug. 21-26; Leg Lake, near Gravenhurst, Ont. Aug. 20; Georgian Bay, Ont. July 2; Algonquin Park, Ont. June 19. Some of these, notably those from Knowlton and Algonquin Park, are considerably darker than the types.

From the west I have long series from Aweme, Man. June 14, Indian Head, Sask. July 10-11 and 26-28 and Waterton Lakes, Alta. July 6-9, which fall here on genitalic characters. The specimens are on the whole larger (notably the females) than eastern ones with darker mesonotum and a tendency for the black suffusion and lateral maculation to extend to the posterior abdominal segments; otherwise I can point to no definite distinctive features and for the present, until more knowledge of the early stages can be obtained, include them all under the name *simulans*.

Eurycaenis prudens n. sp.

(Fig. 10)

Male.—Head lightly suffused with pale brownish; antennae pale, eyes black. Pronotum pale yellowish white with faint smoky tinge in the median section posteriorly. Mesothorax rather a bright brown with slight sepia shading in median area, paler laterally and posteriorly. Metathorax light brown. Pleura pale with episternal area tinged with brown. Abdomen entirely pale yellowish white; forceps very faintly tinged with smoky; setae white. Forelegs with coxae and femora pale smoky, the former widely separated at base; tibiae and tarsi whitish. Mid- and hind-legs entirely whitish. Wings semi-hyaline whitish with subcosta and radius dark for the greater part of their length. Length of body and wing 3 mm.

Female.—Similar to male. Length 3.5 mm.

Holotype— ♂, Saskatoon, Sask., Sept. 9, (K. M. King); No. 3235 in the Canadian National Collection, Ottawa.

Allotype— ♀, same data.

Paratypes—8 ♂, same data.

The species is closely related to the recently described *E. pallida* Ide but shows no black shading on the abdomen; the male forceps are also distinctly shorter. I have four pinned females and a number of specimens of the same sex in alcohol from Lawrence, Kan., July, (Mrs. L. W. Brown) which I think belong here; these show some slight ruddy tinges on the mid-dorsal section of the abdomen but are otherwise similar.

Tricorythodes allectus Needham

Caenis ?allecta Needham, 1905, Bull. 86, N. Y. Sta. Mus. 47, figs. 8, 9, (*partim*, imago *nec* nymph).
Tricorythus allectus Cockerell, 1906, Univ. Colo. Studies III (3) 136; Morgan, 1911, Ann. Ent. Soc. Am. IV, 115 (nymph?).
Tricorythodes allectus Ulmer, 1920, Arch. fur Naturg.. 85, Abt. A, 11, 51.

The identity of this species still puzzles me and while I incline to think the name will eventually be found to take priority over *atratus* McD., I cannot fit the original description to my series of the latter species. Needham's description made, as is his custom, from alcohol material, follows, and I have italicized those portions which conflict with characters in *atratus*:—

"Length 3.5-4.5 mm.; setae about 10 mm. additional; expanse of wings, 8 mm.; foreleg of male 3.5 mm.

General color brown, marked with purplish or slaty grey; head and thorax brown, carinae and margins of ocelli blackish. Wings hyaline, with the usual purplish streak along the radius for two-thirds its length. *Abdomen pale yellowish brown on base and apex, the middle two-thirds washed with grey;* some elongate blackish marks on the lateral margins of the 7th to 9th segments; setae white; antennae, *femora* and forceps *yellowish; tibiae* and tarsi except the terminal joint, *white*".

I have been in correspondence with Dr. Needham regarding *allectus* and he writes me that he can unfortunately find no alcoholic material of the species in his collection; he has kindly forwarded me a slide on which he states 'is mounted what is undoubtedly type material'. This consists of the posterior portions of several male abdomens with genitalia, a single leg and a wing. The genitalia agree with the original figure, except that in the drawing the characteristic oval projection at base of second joint has been omitted; they also seem identical with my slides of *atratus,* especially in the depth of the emargination of the subgenital plate. The leg shows decided traces of black sprinkling on the femur and also a faint ruddy apical band which is often met with in alcohol material of *atratus.*

Based on this slide material I should not have much hesitation in sinking *atratus* to *allectus.* There remains, however, the discrepancy in the abdominal maculation and the fact that at least two species of *Tricorythodes* occur at Ithaca, as material before me, collected by Dr. W. Clemens, distinctly shows. The one, *atratus* (?*allectus*) agrees in size and genitalic characters with Needham's description; the other is considerably larger and might in the female sex fit the description of abdominal maculation given for *allectus.* This larger species I am inclined to consider, on genitalic characters, as an eastern form of *explicatus* Eat. to which, however, it is possible that the name *allectus* might apply; close study at Ithaca is necessary to decide the matter and I leave both names standing for the present in consequence.

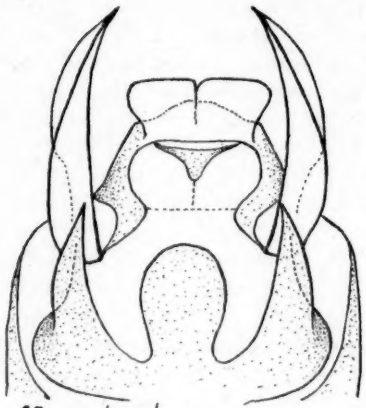
Tricorythodes atratus McD.

(Fig. 11)

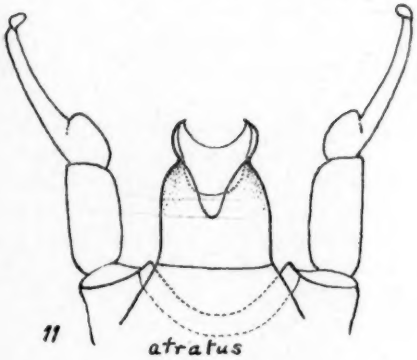
Tricorythus atrata McDunnough, 1923, Can. Ent. LV, 39.

This species will require a more careful characterization than the rather brief one given in the original description.

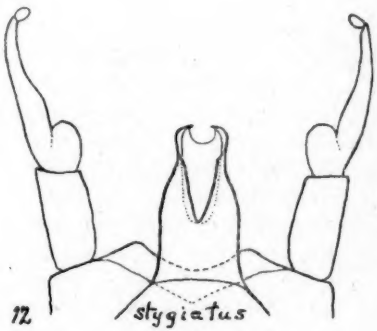
Male.—Eyes and posterior ocelli black; antennae with basal joint tinged with ruddy; head dull blackish with a slight ruddy tinge between the eyes and the posterior excrescences shiny brown. Pronotum dull blackish with some shiny black lateral patches. Mesonotum, pleura and sternum deep shiny black-brown with duller, paler, membranous areas anterior to the wing-bases and around the leg-bases. Abdomen appears dorsally blackish in dried specimens due to black shading over a dirty grey ground color; the lateral areas are rather paler and show traces of a row of small blackish spots; each segment on both its dorsal and ventral edges shows black streaks; ventrally dull, smoky grey. Legs with the coxae and trochanters brownish with slight smoky shading; femora smoky grey, overlaid to a varying extent with black streaks and spots, tending to coalesce to form an apical band which at times (especially in alcohol material) shows



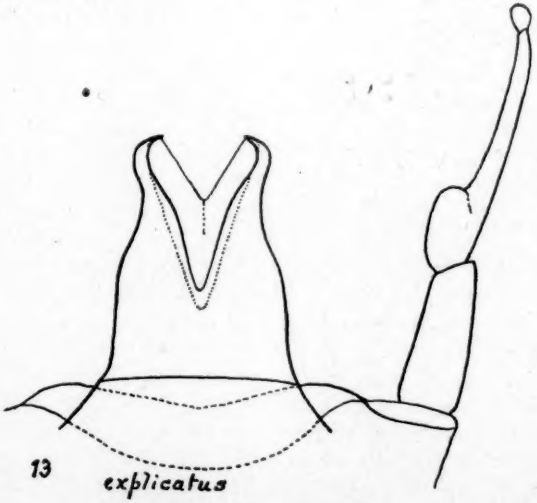
10 prudens



11 atratus



12 stygiatus



13 explicatus

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a ruddy tinge; fore tibia 2 mm. in length, brownish, tarsi pale smoky; mid- and hind-tibiae about as long as the femora, dull whitish with a black basal spot and faint black sprinkling across the middle which frequently shows a ruddy tinge; tarsi whitish. Setae pale with faint smoky tinge on basal joints. Forceps smoky at base, paler apically. Wing length 4-4.5 mm.

Female.—Essentially similar to the male in color and maculation but with the femora and abdomen slightly paler.

Besides the type series from Wakefield, Que. Aug. 6, I have a series of pinned females from Fulford, Que. Aug. 7 and 1 ♂, 2 ♀, in alcohol from the same locality. Characteristic is the sprinkling of black over the dull gray hind femora and the same sprinkling across the mid-section of the pale tibiae.

Tricorythodes stygiatus n. sp.

(Fig. 12)

Male.—Eyes and posterior ocelli black, antennae with basal joint black, paler apically; head dull black with shiny black posterior tubercles. Pronotum dull black on median area, shiny black laterally, a faint ruddy tinge around the mid-dorsal section. Mesonotum shiny blackish, the posterior projection tinged with ruddy. Pleura shiny black with dull areas anterior to wing-bases and at bases of legs. Sternum dull black. Abdomen, dorsally, completely suffused with dull blackish, with slight ruddy tinges in the median area, mostly on the anterior segments; ventrally dull blackish, slightly shiny along lateral edges and with the posterior margin of segments faintly whitish. Genitalia dull whitish. Setae blackish at base, paling to faint smoky outwardly. Prolegs with coxae and trochanters black, femora blackish with a pale longitudinal hyaline streak, tibiae and tarsi whitish with faint ruddy tinge; tibia 1½ mm. in length. Mid- and hindlegs with blackish coxae and trochanters; femora shiny rufo-piceous, tibiae largely rufo-piceous, paling apically, tarsi whitish. Wings whitish hyaline with dark subcostal and radial veins. Length of body 2.5-3 mm.; of wing, 3.5 mm.

Holotype—♂, Cascades Pt., St. Lawrence Riv. Que., Aug. 30, (L. J. Milne); No. 3245 in the Canadian National Collection, Ottawa.

Paratypes—34 ♂, same data.

The species is still blacker than *atratus;* the small size, the deep rufo-piceous hind-femora and the dark tibiae are characteristic. In all the legs the tibiae are shorter than the corresponding joints in *atratus.* Specimens in alcohol show more extended ruddy suffusion dorsally and traces of a fine, pale mid-dorsal abdominal line. The male genitalia are quite similar to those of *atratus* but the excavation between the bases of the forceps is not so deep and the apical edges of this excavation more rounded.

Tricorythodes explicatus Eaton

(Fig. 13)

Tricorythus explicatus Eaton, 1892, Biol. Cent. Am. Neurop. 11.

Through the kindness of the British Museum authorities a male of the type lot, labelled N. Sonora, Mexico (Morrison) is before me; this series was probably captured on the Arizona-Mexico border. I have a number of male specimens from the vicinity of Ft. Davis, Tex. which undoubtedly belong here; the species is typically a large one, as species go in this genus, having a wing length of 6-7 mm. Eaton's description is quite good but it might be noted that, while the eyes and the head are dull black, all three ocelli are shining milky-

white with dark rings only at their bases; the posterior tubercles are shiny. The pronotum is dull black centrally with a broad truncate band of same color extending along the posterior edge, separated from the dull black lateral area by a somewhat hourglass-shaped shiny brown-black patch. The abdomen is entirely dull black with a slight satiny lustre; the forceps are whitish but the penes are shiny black-brown, paler at base, and bent upward almost at right angles. The foretibia is 2.5 mm. long and light brown in color; all femora are deep pitchy brown, the mid- and hind-tibiae shaded with same color, paling apically into yellowish white; tarsi yellowish white. I have seen no females.

A series from Yellowstone Park, Wyo., July 28 and Sept. 30, also appears to belong here although the specimens are somewhat smaller, with rather paler-colored legs; females taken at the same time (Sept. 30) and which I presume can be associated with the males, are much paler; the lateral portions of the abdominal segments III-VII being broadly yellowish and the ventral surface entirely pale; the legs, except the fore femur and tibia are pale with some blackish streaks on the mid- and hind-femora and a black dot on the coxa. I have before me a similar series from Waskesiu Lake, Prince Albert Nat. Park, Sask., Aug. 25, (King), some of the specimens being almost as large as the Texan ones. In southern Alberta (Lethbridge, Medicine Hat) a much smaller form occurs in number in late August and early September, the wing length averaging about 5 mm. I should have been disposed to consider this a distinct species if it were not for the fact that nymphs from this region agree with some I have from the Yellowstone Park rivers; it would appear therefore, as if the smaller size were due to climatic conditions.

Attention might be called to the fact that in the Alberta form the posterior ocelli are generally black-brown and only occasionally with traces of the milky color so prominent in the typical race; the femora are paler and not so completely suffused with dark shading and this shading is less brownish and more sooty in color. I can find no genitalic differences apart from size; from the two preceding species *explicatus* differs in the very shallow excavation of the sub-genital plate.

A form of this species which I have mentioned under *allectus,* occurs in the east; it is rather duller in color than western specimens but shows no genitalic differences. I have examined several specimens from Wakefield, Que., July 26, others from Knowlton, Que. (Aug.) including nymphs from Brome Lake, Lake Nipigon, Ont., July 27 and a small series from Fall Creek, Ithaca, N. Y., June 29 (Clemens).

SOME ERYTHRONEURA (GRAPE LEAF HOPPERS) OF THE MACULATA GROUP. (HOMOPTERA CICADELLIDAE)

BY R. H. BEAMER

Department of Entomology, University of Kansas, Lawrence, Kansas.

(continued from page 244)

21. **Erythroneura teres** n. sp.

General ground color yellowish white to semihyaline marked with orange. Vertex with three white spots surrounded by thin orange bands. Pronotum with median U-shaped orange mark of varying thickness usually not touching either margin. Usual triangular spots back of each eye. Scutellum with tip

orange, basal angles yellow more or less surrounded by orange. Clavi with well defined anchor-shaped spot in basal half and another spot just before tip. Coria with small spot near humeral angle, another arising near anterior end of costal plaque, of varying width, touching claval suture near point of anchor, practically surrounding plaque then angling to end just before base of cell M_4. Cross-veins for most part orange. Tips of tegmen more or less dusky. Black spot in posterior end of costal plaque and larger one in base of cell M_4. Venter stramineous.

Genitalia. Pygofer hook single, very long and slender, curving from near base to about middle where it curves back almost even with base. Sides almost parallel. Style with medium foot; curved base; heel large; anterior point short, almost a right angle; posterior point at least half as long as foot, narrow, sides converging to sharp point. Oedagus of medium length almost parallel-sided, straight from any view.

Holotype; male, Johnson Co., Ill., March 30, 1929; R. H. Beamer.

Paratypes; four males, Johnson Co., Ill., Beamer and Oman; one male, Nashville Tenn., Dec., 1927; R. H. Beamer.

22. **Erythroneura clavipes** n. sp.

General ground color yellowish white to hyaline with orange markings. Vertex with median oval, orange spot and semblance of dash anterior to inner margin of each eye. Pronotum with median triangular-shaped orange spot with anterior corners slightly prolonged, this mark usually not reaching either margin. Usual angular mark back of each eye. Scutellum with orange spot on tip and basal angles usually yellow. Tegmen with following orange marks; clavus with anchor-shaped mark in base, rather narrow and sharply pointed, and spot just before tip; coria with spot on humeral angle, another arising in costal margin, angling to claval suture between anchor mark and spot near apex, connected or not to another mark arising at posterior end of costal plaque, and crossing coria toward base of cell M_4. Cross-veins partially orange. Small black spot in base of cell M_4 and in posterior end of costal plaque, tips more or less tinged with brown. Venter stramineous.

Genitalia. Pygofer hook single; rather heavy with quite a distinct inward bend toward tip. Style with medium foot, practically without heel, anterior or posterior point. Oedagus of medium length; in lateral view very broad, sharply curved dorsally, tapering on outer third to a medium sharp point.

Holotype; male, Anderson Co., Kans., Sept., 9, 1927, R. H. Beamer.

Paratypes; 2 males, same data; 3 males, Douglas Co., Kansas; 2 males, Leavenworth Co., Kans.; 1 male, Nashville, Tenn.; 3 males, Riley Co., Kans.; 1 male, Marshall, Ark.

This species may be distinguished by foot of style without points coupled with the very broad curved oedagus in lateral view.

23. **Erythroneura penesica** n. sp.

General ground color yellowish white to semihyaline, marked with red to orange. Vertex with semblance of three white spots more or less surrounded with thin bands of orange or red. Pronotum usually with rather narrow median triangular spot not reaching either margin, usual angular spot behind each eye. Scutellum with spot on tip, basal angles yellow outlined with

red or orange on outer edges. Clavi with usual anchor spot in base and spot just before tip. Coria with small spot on costal margin near humeral angle, another arises on costal margin at anterior end of costal plaque, angles toward outer spot on clavi but does not reach it, another rather wide, broken vitta arises at posterior end of costal plaque, angles toward and ends near mesal margin just before base of cell M_4. Usually with a black spot in posterior end of costal plaque and larger one in base of cell M_4, former is sometimes absent. Tips of tegmen more or less dusky. Venter stramineous with pink markings.

The markings in this species are usually broken, the anchor mark of clavi usually the only solid one.

Genitalia. Pygofer hook single, short, almost straight on inner margin, curved in slightly on outer. Style with rather large foot; base curved; heel medium; anterior point small, about a right angle; posterior point about as long as foot, straight or slightly curved. Oedagus of medium length in ventral view, rather stout, wide at base, narrowing in middle, widening again at tip, sides slightly serrate.

Holotype; male, Anderson Co., Kans., Nov., 26, 1927; R. H. Beamer.

Paratypes; 7 males, Ill., 1929, Beamer and Oman; 1 male, Plummer's Island, Md., W. L. McAtee; 8 males, Wrens, Ga. 1930, R. H. Beamer; 1 male, Polk Co., Ark.; and 2 males, Washington, D.C.

24. **Erythroneura rostrata** n. sp.

General ground color yellowish white to semihyaline. Color markings orange. Vertex with two longitudinal vittae united at both ends and connected to each eye near their middle by a much narrower line. Pronotum with a medium triangular spot with semblance of connection to anterior margin at each front corner, usual angular spot behind eyes. Scutellum with tip orange, basal angles yellow margined with orange on outer corners. Clavi with usual basal anchor-shaped spot, and spot just before tip. Coria with spot on costa midway between base of wing and costal plaque, vitta arising at anterior end of costal plaque more or less surrounding it, extending almost to claval suture, ending near mesal margin of wing just before base of cell M_4. Latter part of this vitta more or less broken, often appearing as orange markings of longitudinal veins. Small black spot in posterior end of costal plaque, larger one in base of cell M_4. Tips of tegmen more or less dusky. Venter stramineous.

Genitalia. Pygofer hook long and slender, single, turning sharply in for first half its length then curving out again rather evenly to end about even with its base. Style with rather short foot; base almost straight making slightly less than a right angle with the posterior point; heel large; anterior point short and blunt protruding out; posterior point almost as long as base of foot. Inner margin straight, outer curved. Oedagus of medium length, quite thick in lateral view, much curved dorsally. Both the oedagus and styles resemble, somewhat, the beak of carnivorous birds.

Holotype, male, Leavenworth Co., Kans., April 28, 1928; R. H. Beamer.

Paratypes; three males, same data; 1 male, Clayton Co., Iowa, R. H. Beamer; and 1 male, Oxford, Ind., W. L. McAtee.

(to be continued)

BOOK REVIEW

A Laboratory Guide to the Study of the Wings of Insects. By James Chester Bradley, Ph. D., Professor of Entomology, Cornell University. Daw, Illiston & Co., Ithaca, N.Y., 1931, 41 pp., 10 figs., accompanied by an envelope of 68 unbound outline plates.

Suggestions for the Instructor in Connection With the Use of the Laboratory Guide to the Study of the Wings of Insects. By the same author, with the same imprint. 17 leaves, lithoprinted on one side, illustrated.

Dr. Bradley is to be congratulated upon his wise selection of the material and methods best suited for inculcating in the students of entomology a first-hand knowledge of the fundamental principles of phylogeny, comparative anatomy and the structures most used in taxonomic work; and his "Guides" are recommended very highly to those engaged in training future entomologists.

In selecting the venational studies as the basis of this work, the author states that there are three points of view from which the study of insect wings may be approached: (a) as a laboratory training in phylogenetic processes; (b) as an elementary training in research methods of comparative morphology; (c) for the purpose of acquainting the student of entomology with the details of the venation of insects' wings for taxonomic use. The materials for carrying out this three-fold purpose are amply provided by sets of figures and a book of directions furnished to each student.

The figures of wings are printed in pale ink on unbound 5 x 8 inch sheets, and are intended to serve as outlines over which the student may make finished drawings in colored inks. The time that would otherwise be spent in making free-hand drawings from mounted wings in the laboratory, is thus conserved for study of the venation. The finished drawings, being on individual sheets, may be re-arranged according to the ideas of the student, as he traces the progressive modification of the various veins.

The "Laboratory Guide" is planned with a view to developing the student's ability to reason out for himself, with the minimum of assistance, the interpretation of the venation of the several series of wings and the lines of development followed in their production. The "Suggestions for the Instructor", on the other hand, discusses critically the interpretations of various points in the wings which might be open to misunderstanding or doubt.

The uniform terminology of Comstock and Needham is of course employed as a basis for the work, since this "is now the only widely used system applicable to more than a single order of insects." Radical departures, however are made from the interpretation of these authors in the orders Odonata, Ephemerida and Hymenoptera and to some extent, in the Diptera also. The modern conception of the homologies of the veins in Odonata and Ephemerida is based upon the recent findings of Lameere, Martynov, Tillyard and Carpenter in the field of palaeoentomology, and involves a return, in large measure, to the long neglected idea of convex and concave veins, first suggested by Adolph. Dr. Bradley's views concerning the interpretation of the fore wing of Hymenoptera appears to have been suggested by a comparison with the venation of the Psocids, and are almost identical with those suggested by the reviewer in the Canadian Entomologist, 1922, Plate 9, figs. 65 and 66, from a similar comparison of a Psocid and Hymenopterous fore wing. The interpretation of the Dipterous venation given in the "Suggestions for the Instructor" conforms, in large measure, to that of Tillyard and Alexander.

In referring to the veins of the cubital and anal regions of insects in general, the terminology of Comstock is adopted for designating the branches of cubitus and the first anal vein (i.e. Cu_1, Cu_2, and Ist.A), and the terminology of Tillyard (who renamed them respectively Cu_{1a}, $Cu_1{}^b$, and Cu_2) is rejected. In the "Suggestions for the Instructor", mention is made of the use by Forbes of the term "plical vein" (for which the reviewer had previously proposed the designation, "preanal vein") for the vein variously regarded as the true second cubital (Tillyard) or the first anal (Comstock).

The study of the wings of the Odonata and Ephemerida and also of the Corrodentia is led up to by a simple series of fossil wings representing extinct orders and superorders. The Odonata and Ephemerida, with the fossil orders Palaeodictyoptera, Protephemerida and Protodonata, are dealt with as a major division of winged insects in the original outline, under Martynov's term "Palaeoptera", but in a sheet of "Corrections", as well as in the "Suggestions for the Instructor", Martynov's designation "Palaeoptera" and his term "Neoptera" (applied to the remainder of winged insects) have been changed to "Archipterygota" and "Neopterygota" (proposed by the reviewer in 1924) because the term "Palaeoptera" was preoccupied in 1915 (Entomological News, Vol. 26, p. 349), having been applied to the Blattids as an ordinal designation, and the term "Neoptera" was preoccupied in 1906 (Univ. of California Publications Technical Bulletins, Vol. 1, No. 1, p. 129, "The Wing Veins of Insects") by Woodworth, who applied the designation "Neoptera" to the orders Diptera, Hymenoptera and Lepidoptera alone—and of course, the designation Archipteradelphia, proposed in the Canadian Entomologist for 1922, p. 231, has priority over Martynov's term "Palaeoptera" as well.

The hypothetical type of venation worked out by Comstock and Needham, Dr. Bradley finds more suitable for serving as the archetype of the Neopterygota alone, rather than for all insects (including the Archipterygota), and Plate 1 consists of a figure essentially similar to Comstock's, except that the second and third anals are each figured as having two branches; the axillary and preaxillary incisions are indicated: the "vena arcuata" and "vena cardinalis" of Martynov are included: and the base of cubitus is shown attached not only to the first anal, but also to media, being attached to the latter vein by the posterior arculus, which is interpreted as being probably M_5, in accordance with Tillyard's terminology. For the Archipterygota on the other hand, Doctor Bradley's archetype differs from Comstock's hypothetical type of wing venation by the addition of a precostal vein; by the addition of the convex anterior media (of Lameere); and by showing the anal veins as a parallel series of indefinite number.

In order to help the student to grasp the phylogenetic significance of the work he is doing he is required to construct for himself phylogenetic trees; and an exercise is included for the purpose of teaching the future taxonomist how to construct (and how *not* to construct) taxonomic keys.

The course ends with a comparison of the older systems of terminology used by different taxonomists in the orders Diptera, Lepidoptera and Hymenoptera; and three plates are provided, to be labelled by the student in accordance with the older systems, so that he may be familiar with these when he encounters them in the publications which do not employ the Comstock-Needham system.

G. C. CRAMPTON.